

Hydrogen concentration in prebiotic Earth's atmosphere – new simulation results and discussion of multi-component hydrodynamic escape

Feng Tian

*Department of Astrophysics and Planetary Sciences/ Laboratory for Atmospheric and Space Physics
University of Colorado at Boulder
Campus Box 392
USA
tian@colorado.edu*

Owen B. Toon

*Laboratory for Atmospheric and Space Physics/Program in Atmospheric and Oceanic Science
University of Colorado at Boulder
Campus Box 392
USA*

Alex A. Pavlov

*Laboratory for Atmospheric and Space Physics
University of Colorado at Boulder
Campus Box 392
USA*

We have found that hydrogen escape from early Earth's atmosphere should have occurred at rates two orders of magnitude slower than the diffusion limited escape rates. The balance between slow hydrogen escape rate and hydrogen volcanic outgassing rate could have maintained an atmospheric hydrogen mixing ratio more than 30%, two orders of magnitude greater than previously predicted. Prebiotic organic molecules can be formed efficiently in a hydrogen rich early Earth atmosphere and an organic rich soup in the oceans, an environment friendly to the origin of life, could have been created. We have also studies multi-gas hydrodynamic escape from early Earth's atmosphere and discuss its influence on the hydrogen escape rate.